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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/509,338	10/08/2004	Takehiro Ueda	260055US2SPPCT	2024

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EXAMINER	
DAHIMENE, MAHMOUD	
ART UNIT	**PAPER NUMBER**
1765	

NOTIFICATION DATE	DELIVERY MODE
09/07/2007	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/509,338	UEDA ET AL.	
	Examiner	Art Unit	
	Mahmoud Dahimene	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 June 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claim s 1, 7, 9-12, 18, 20-26, are rejected under 35 U.S.C. 103(a) as being unpatentable over Flanigan et al. (US 6,081,414) in view of Sundar (US 2001/0016157) and Sung et al. (US 6,347,990).

Regarding claims 1, 7, 12, 18, the reference of Flanigan et al. (US 6,081,414) describes an apparatus for improved biasing and retaining a workpiece in a plasma process chamber comprising an electrostatic chuck-pedestal (block) (figure 2) having a flow path of a heat medium in an inner part (236 and 220), a component (105) in the

vacuum processing chamber disposed to be in contact with the block and made at least partly of an insulative material. The pedestal temperature is controlled by circulating an insulative fluid (coolant) (column 2, line 44) as the heat medium in the flow path (236). The wafer is transferred to/from the chamber from/to a loadlock (figure 1) the wafer is plasma processed. The coolant is continuously circulating even during wafer transfer when no plasma is generated in order to maintain chuck temperature during wafer transfer. The vacuum in the chamber is controlled for PVD or other processes. Flanigan cites "In operation, a wafer (102) is placed on the support surface (103) of the electrostatic chuck (105). Air is drawn out of the chamber (100) via a vacuum pump (128) to create a low pressure environment (i.e. 1 mTorr to 5 Torr). A reactant gas, preferably Argon (argon is an inert gas), is introduced into the chamber (100) from one of the remote gas sources" (column 7, line 19), pressure is controlled during Argon flow. carrying the object to be processed into the vacuum processing chamber generating plasma to plasma-process the object to be processed and carrying the object to be processed that has undergone the processing out of the vacuum processing chamber between said processing of the object to be processed and processing of a subsequent object to be processed, circulating the insulating fluid in the flow path while the object to be processed is not in the vacuum processing chamber and no plasma is generated are steps conventionally used in semiconductor wafer processing as suggested by Flanigan.

It is noted that Flanigan is silent about controlling pressure in the vacuum processing chamber to a predetermined pressure while supplying inert gas into the vacuum processing chamber.

Sundar teaches a purge gas of argon or nitrogen is conventionally supplied to the transfer chamber citing "the transfer chamber is provided with a purge gas inlet, such as from an argon or nitrogen source. The purge gas may be delivered to the transfer chamber continuously or only as needed to provide a sufficient high pressure to cause a positive gas flow out of the transfer chamber" (page 9, paragraph 0099). Examiner interprets "continuously or as needed" to describe a gas purge that could be set to accomplish the desired function of maintaining a pressure differential between adjacent chambers, including controlling the gas/pressure flow with conventionally known equipment such as valves and pressure gages, including intermittent flow when the chambers gate(s) are closed-open-closed (in order to maintain pressure differential).

Sung discloses "In sharp contrast, by maintaining higher air pressure in the process area than in the transfer area, the present invention can reduce and preferably eliminate particle flow from the transfer area to the process area" (column 3, line 39).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Flanigan to maintain a higher pressure in the process chamber (plasma chamber) as suggested by Sung, by flowing argon because as suggested by Sundar argon purge is conventionally used vacuum systems, and argon is already available in Flanigan's process chamber. One of ordinary skill in the art would have been motivated to flow argon in the process chamber to keep

a higher pressure in the process chamber while the wafer is being transferred in order to reduce and preferably eliminate particle flow from the transfer area to the process are, when the transfer area in known to have higher particle density that the process chamber, as suggested by Sung. The examiner interprets "continuously or as needed" to describe a gas purge that could be set to accomplish the desired function of maintaining a pressure differential between adjacent chambers, including controlling the gas/pressure flow with conventionally known equipment such as valves and pressure gages, including intermittent flow when the chambers gate(s) are closed-open-closed (in order to maintain pressure differential). Wafer transfer is conventionally performed when no plasma is generated.

As to claims 9, 10, 11, 20, 21, 22, in PVD or any other plasma process the pressure in the process chamber is controlled by a computer system which convetionally operates with a predetermined sampling rate for measuring and regulating the pressure which makes the controlling process intermittent. When the control loop is initiated, the pressure is controlled even when flow rates are varied or fixed.

As to claims 23, 25, The pedestal (block) of Flanigan is made of a conductive material (234 and 106).

As to claims 24, 26, it would appear that, in the apparatus of Flanigan, the higher process chamber pressure of Sung would also suppress charging of the component in the vacuum.

Claim Rejections - 35 USC § 103

4. Claims 2, 7, 13, 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Flanigan et al. (US 6,081,414) in view of Sundar (US 2001/0016157) and Sung et al. (US 6,347,990) as applied to claims 1, 9-12, 20-26 above, and further in view of Watanabe et al. (US 5,625,526).

Regarding claims 2, 13, it is noted that Flanigan is silent about a fluorinated refrigerant.

The reference of Watanabe describes an electrostatic chuck system wherein a fluorinated refrigerants such as (R-22) are conventionally used as a cooling medium (column 23, line 36).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Flanigan to include a fluorinated refrigerants such as (R-22) for cooling the pedestal because Watanabe teaches those refrigerants are conventionally used for wafer cooling. One of ordinary skill in the art would have been motivated to use a fluorinated refrigerant when processing requires low wafer temperature.

As to claims 7, 18, it is noted that Flanigan is silent about nitrogen gas.

The reference of Watanabe teaches "Both the plasma generating operation and the process gas supplying operation are stopped after completed plasma etching. In addition, a nitrogen gas is introduced into the process chamber 504 to replace the process gas and reaction products, and the process chamber 504 is evacuated" (column 21, line 25).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Flanigan to include nitrogen as the purging gas because Watanabe teaches nitrogen is conventionally used for purging chambers. One of ordinary skill in the art would have been motivated to used nitrogen as the purging gas because of the low financial and environment cost associated with the production and use of nitrogen.

Claim Rejections - 35 USC § 103

5. Claims 3-5, 14-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Flanigan et al. (US 6,081,414) in view of Sundar (US 2001/0016157) and Sung et al. (US 6,347,990) as applied to claims 1, 9-12, 20-26 above, and further in view of Nagasaki (US 6,215,643).

Regarding claims 3, 4, 5, 14, 15, 16, it is noted that Flanigan is silent about the volume resistivity of the ceramic.

The reference of Nagasaki describes a ceramic electrostatic chuck, with an aluminum base (11), system and discloses to establish the Johnson-Rahbeck effect, a ceramic portion present between an electrode and an attractive surface of an electrostatic chuck needs to have a volume resistivity of not lower than 10^9 Ω-cm and lower than 10^{11} Ω-cm in a process temperature range. (column 1, line 45).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Flanigan to include ceramic as an insulative material with volume resistivity 10^9 Ω-cm or higher positioned on an

aluminum base because Nagasaki teaches the resistivity range of 10^9 Ω-cm to 10^{11} Ω-cm are conventional for electrostatic chucks. Overlapping ranges are held obvious.

Claim Rejections - 35 USC § 103

6. Claims 6, 8, 17, 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Flanigan et al. (US 6,081,414), Sundar (US 2001/0016157) and Sung et al. (US 6,347,990) in view of Nagasaki (US 6,215,643) as applied to claims 3-5, 14-16 above, and further in view of Paschen (from F. Paschen published paper (Wied. Ann., 37, 69, 1889) see attached page).

Regarding claims 6, 8, 17, 19, It is noted Flanigan is silent about setting a pressure range for a given gap distance between electrodes in the chamber based on the Paschen curve for a given gas including nitrogen.

In general Paschen curves for different gases indicate voltage breakdown of the gas as a function of pressure (and gap distance) as shown in the attached figure from the reference of Paschen.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Flanigan to include the teachings of Paschen which indicate, that for a given gas and gap distance, ignition of a plasma has a minimum voltage, the pressure region around this minimum require a voltage only slightly higher than the minimum breakdown voltage. One of ordinary skill in the art would have been motivated to select a pressure range with a lower limit high enough to be above the transfer chamber pressure including 0.6 times the lowest sparking

pressure for nitrogen as defined by the proper Paschen curve, and a higher limit not too high such as to create a high pressure back-flow from the process chamber to the transfer chamber. Applicant has not shown any unexpected results in selecting a pressure not lower than 0.6 times nor higher than 2.0 times the pressure yielding the lowest breakdown voltage (or 13 Pa to 40 Pa for the case of nitrogen gas), any pressure near the minimum value would have yielded higher breakdown voltage, which is desirable.

Response to Arguments/Remarks

7. Applicant's arguments filed 6/20/2007 have been fully considered but they are not persuasive.

Regarding applicant's argument that Flanigan is directed toward plasma processing whereas the pressure environment recited in claim 1 is directed at the idle state (pages 4-5). The office action cites the reference of Sung for teaching, during idle, higher air pressure is maintained in the process area, higher than in the transfer area, the invention of Sung can reduce and preferably eliminate particle flow from the transfer area to the process area" (column 3, line 39). The office action cites the reference of Sundar for teaching argon and nitrogen are conventionally used as purge gases in semiconductor manufacturing. And Flanigan is shown to have the pressure and flow to maintain (1 mTorr to 5 Torr). Motivation for combining the reference was provided in the office action. As to the argument about Sung disclosing Air versus an inert gas, one of ordinary skill in the art would be motivated to replace air with an inert gas in order to

lower the contamination risk from air, as is taught by Sundar. The reason air chamber purging is avoided in semiconductor manufacturing is because air might carry particles and contaminants such as moisture or others that are harmful to a wafer, whereas inert gases are highly purified and are available for "electronic grade" purpose, which is within the knowledge of one of ordinary skill in the art.

Regarding applicant's argument that claim 1 is directed toward suppressing charging, this argument is not persuasive because it is not commensurate with the scope of claim 1. Claim 1 does not recite the limitation of "suppressing charging".

Conclusion

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mahmoud Dahimene whose telephone number is (571) 272-2410. The examiner can normally be reached on week days from 8:00 AM. to 5:00 PM..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

MD

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER